

DOCKETED

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Supporting transformative projects in electrification of oceangoing vessels

Additional submitted attachment is included below.



Electric Program Investment Charge 2026–2030 (EPIC 5) Research Concept Proposal Form

The California Energy Commission (CEC) is currently soliciting research concept ideas and other input for the Electric Program Investment Charge 2026–2030 (EPIC 5) Investment Plan. For those who would like to submit an idea for consideration, please complete this form and submit it to the CEC by **August 8, 2025**. More information about EPIC 5 is available below.

To submit the form, please visit the e-commenting link:

<https://efiling.energy.ca.gov/EComment/ECommentSelectProceeding.aspx> and select the Docket **25-EPIC-01**. Enter your contact information and then use the “choose file” button at the bottom of the page to upload and submit the completed form. Thank you in advance for your input.

1. Please provide the name, email, and phone number of the best person to contact should the CEC have additional questions regarding the research concept:
2. Please provide the name of the contact person’s organization or affiliation:
3. Please provide a brief description of the proposed concept that you would like the CEC to consider as part of the EPIC 5 Investment Plan. What is the purpose of the concept, and what would it seek to do? Why are EPIC funds needed to support the concept?

We advocate for the establishment of a mechanism to support the construction and initial operations of a zero-emission ocean-going research vessel.

Specifically, Scripps Institution of Oceanography (UC San Diego) has completed the design and obtained class *Approval In Principle* for a novel liquid hydrogen fueled zero-emission oceanographic research vessel capable of full-service long-duration scientific missions on the high seas. This project boldly advances California’s emissions and climate goals by demonstrating

hydrogen fuel cell viability to inform maritime industry decarbonization while supporting expansion of a clean hydrogen ecosystem.

EPIC funds are needed because the business model of academic research vessels precludes commercial financing -- we rely on government funds for capitalization of our ships, which we operate for the benefit of California's scientists and students.

4. In accordance with Senate Bill 96ⁱ, please describe how the proposed concept will "lead to technological advancement and breakthroughs to overcome barriers that prevent the achievement of the state's statutory energy goals." For example, what technical and/or market barriers or customer pain points would the proposed concept address that would lead to increased adoption of clean energy technology or innovation? Where possible, please provide specific cost and performance targets that need to be met for increased industry and consumer acceptance. For scientific analysis and tools, provide more information on what data and information gaps the proposed concept would help fill, and which specific parties or end users would benefit from the results, and for what purpose(s)?

This first-of-its-kind vessel will demonstrate the viability of zero-emission power in long-duration oceangoing vessels. Other projects have demonstrated hydrogen power, but those have been short-haul ferries using compressed gas rather than LH2). The higher energy density of LH2 affords greater range and endurance, but comes with technical challenges that our project (as a noncommercial research vessel) is ideally suited to tackle. In addition to advancing California's clean air goals, this ship will contribute to the establishment of a sustainable hydrogen value chain in California, and fulfill a much-needed role as an early reliable offtaker of low-carbon LH2. A strong consumer signal is important for the rapid commercial viability of low-carbon hydrogen production facilities in California. Our hydrogen-powered electric ship will be an important element in the establishment of an economically sustainable clean hydrogen ecosystem in California.

5. Please describe the anticipated outcomes if this research concept is successful, either fully or partially. For example, to what extent would the research reduce technology or ratepayer costs and/or increase performance to improve the overall value proposition of the technology? What is the potential of the innovation at scale? How will the innovation lead to ratepayer benefits in alignment with EPIC's guiding principles to improve safety,ⁱⁱ reliability,ⁱⁱⁱ affordability,^{iv} environmental sustainability,^v and equity?^{vi}

Our product will be a fully-capable ocean-going research vessel that will be commissioned into service within the U.S. Academic Research Fleet, with an intended service life of at least 30 years. Our vessel design has already passed important safety and reliability milestones with U.S. Coast Guard and American Bureau of Shipping, and our next steps are to assemble and demonstrate this approach. Importantly, the first several years of operation will be critical to demonstrating those characteristics, as well as the overall environmental sustainability of this type of maritime power. Equally important will be our demonstration of rapid, safe, efficient refueling. Our design involves a mobile refueling solution that will enable refueling at any pier or wharf that can accommodate a highway tanker truck (already a routine means of refueling with diesel), without the need for a specific fueling terminal or port infrastructure. Successful demonstration of hydrogen fuel cell technology on ocean-going maritime platforms supports not only decarbonization efforts, but also the reduction of criteria pollutants, which disproportionately harm disadvantaged portside communities

6. Describe what quantitative or qualitative metrics or indicators would be used to evaluate the impacts of the proposed research concept.

We will measure and document the emission profile of the vessel to quantify benefits and compare to conventional fossil-fuel propulsion systems. As part of the U.S. Academic Research Fleet, the vessel will be subject to inspection and evaluation by the U.S. National Science Foundation, which will yield qualitative assessments of vessel capabilities, performance, and impact on the scientific community. Scientific benefits (which include quiet, non-polluting operations during sampling) are evaluated by the shipboard scientific party following every deployment, which will provide regular surveillance on the capability and performance of the ship.

7. Please provide references to any information provided in the form that supports the research concept's merits. This can include references to cost targets, technical potential, market barriers, equity benefits, etc.

We conducted feasibility studies of marine LH2 power systems with applications to oceangoing research vessels, with funding from the U.S. Maritime Administration. These reports involve not only the technical feasibility, but the feasibility in terms of constructability, regulatory framework, economics, emissions benefits, and satisfaction of science mission requirements.

Klebanoff, Leonard E., et al. "Comparative study of a hybrid research vessel utilizing batteries or hydrogen fuel cells." *International Journal of Hydrogen Energy* 46.76 (2021): 38051-38072.

Klebanoff, Leonard E., et al. *Feasibility Study of replacing the R/V Robert Gordon Sproul with a hybrid vessel employing zero-emission propulsion technology*. No. SAND-2020-10530R. Sandia National Lab.(SNL-CA), Livermore, CA (United States); Glosten, Seattle, WA (United States); Univ. of California, San Diego, CA (United States). Scripps Inst. of Oceanography, 2020.

Madsen, R. T., et al. "Feasibility of the Zero-V: A zero-emissions hydrogen fuel-cell coastal research vessel." *International Journal of Hydrogen Energy* 45.46 (2020): 25328-25343.

8. The EPIC 5 Investment Plan must support at least one of five Strategic Goals:^{vii}
- a. Transportation Electrification
 - b. Distributed Energy Resource Integration
 - c. Building Decarbonization
 - d. Achieving 100 Percent Net-Zero Carbon Emissions and the Coordinated Role of Gas
 - e. Climate Adaptation

Please describe in as much detail as possible how your proposed concept would support these goals.

This project addresses Transportation Electrification. The maritime industry, especially long-range ocean-going vessels, is difficult to decarbonize due to the prevalence and technical maturity of diesel. This is an important industry to decarbonize due to the large-scale and global nature of maritime emissions, which is beginning to be regulated by the International Maritime Organization, and is an arena that California is strongly positioned to take a leadership role through projects like ours.

About EPIC

The CEC is one of four EPIC administrators, funding research, development, and demonstrations of clean energy technologies and approaches that will benefit electricity ratepayers of California's three largest investor-owned electric utilities.

EPIC is funded by California utility customers under the auspices of the California Public Utilities Commission.

To learn more about EPIC, visit: <https://www.energy.ca.gov/programs-and-topics/programs/electric-program-investment-charge-epic-program>

EPIC 5 documents and event notices will be posted to:
<https://www.energy.ca.gov/proceeding/electric-program-investment-charge-2026-2030-investment-plan-epic-5>

Subscribe to the EPIC mailing list to stay informed about future opportunities to inform the development of EPIC 5:

<https://public.govdelivery.com/accounts/CNRA/signup/31897>

i See section (a) (1) of Public Resources Code 25711.5 at:

https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=PRC§ionNum=25711.5.

ii EPIC innovations should improve the safety of operation of California's electric system in the face of climate change, wildfire, and emerging challenges.

iii EPIC innovations should increase the reliability of California's electric system while continuing to decarbonize California's electric power supply.

iv EPIC innovations should fund electric sector technologies and approaches that lower California electric rates and ratepayer costs and help enable the equitable adoption of clean energy technologies.

v EPIC innovations should continue to reduce greenhouse house gas emissions, criteria pollutant emissions, and the overall environmental impacts of California's electric system, including land and water use.

vi EPIC innovations should increasingly support, benefit, and engage disadvantaged vulnerable California communities (DVC). (D.20-08-046, Ordering Paragraph 1.) DVCs consist of communities in the 25 percent highest scoring census tracts according to the most recent version of the California Communities Environmental Health Screening Tool (CalEnviroScreen), as well as all California tribal lands, census tracts with median household incomes less than 60 percent of state median income, and census tracts that score in the highest 5 percent of Pollution Burden within CalEnviroScreen, but do not receive an overall CalEnviroScreen score due to unreliable public health and socioeconomic data.

vii In 2024 the CPUC adopted five Strategic Goals to guide development of the EPIC 5 Investment Plan. A description of the goals can be seen in Appendix A of CPUC Decision 24-03-007 available at:

<https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M527/K228/527228647.PDF>